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The Cryosphere Discussions

Interactive comment on "Thresholds in the sliding resistance of simulated basal ice" *by* L. F. Emerson and A. W. Rempel

L. F. Emerson and A. W. Rempel

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Thank you, Andrew, for your close reading and thoughtful comments. We appreciate the opportunity to clarify the presentation of our experimental results. The manuscript will be revised to address all of the issues that you have identified. Answers to specific questions that you raised are given below.

Referee comments are in quotes.

"Running an experiment by decreasing normal stress rather than increasing it will show that your results are not biased by displacement history."

We reversed the order of loading and ran two additional sets of experiments. The results were the same. This will be mentioned in the revised manuscript.

"The distinction between h and h_p is unclear in the text."

We use the parameter h to refer to the thickness of the water layer that separates the ice from the glass. We use h_p to refer to the minimum thickness of the water layer that separates the ice from the particles. We will clarify the difference in the text and the caption to figure 5, which shows schematically how the water layer thickness varies between these two limits.

General Comments:

1) Regarding the cohesion, in the 'sandy regime' the intercepts of the linear regressions were indistinguishable from zero – so for these cases the cohesion was zero. The linear regressions in the 'slippery regime' did not have statistically significant slopes, and the intercepts are not significant either. We could, however, identify the average shear stress measured in these experiments as representing a kind of cohesive-like behavior. The table will be amended to include this information.

2) We will list the measured μ of 0.38 for the sand control disks in the revised Table 1.

3) Thanks for pointing this out. We will make the distinction between h and h_p clearer in the revised manuscript.

4) The issue of data scatter is clearly important and we will add a brief discussion of its potential sources in the revised manuscript. We attempted to keep conditions as constant as possible. However, inhomogeneous mixing and particle settling prior to freezing of the ice disks was probably responsible for some of the data scatter. We recorded video footage of the sliding surface during our experiments, but unfortunately we were not able to visually identify the source of the scatter. Since the ice was melting over the course of the experiments, slight differences to the sliding surface undoubtedly did take place. For example some particles that began the experiments completely encapsulated by ice were introduced to the sliding surface later as the ice melted from beneath them. Some particles that began on the sliding surface were dislodged and left behind. From the short duration of each sliding experiment and the measured melting rates, we were able to estimate the rates at which these changes took place and verify

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that they represented only a small fraction of the total number of particles on the sliding surface. They may, nevertheless, have been responsible for some of the experimental scatter.

The manuscript will be revised to address each of the 'specific comments' you made. Thanks again,

Lisa Emerson and Alan Rempel

Interactive comment on The Cryosphere Discuss., 1, 99, 2007.